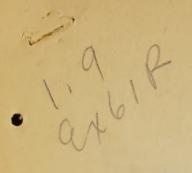
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ANIMAL HUSBANDRY DIVISION
HAWAII AGRICULTURAL EXPERIMENT STATION
HONOLULU, HAWAII

Under the joint supervision of the * JUN 14 1934 *

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Progress Notes on Experiments and Other Items of Interest

No. 6

May, 1934

These progress notes on experimental work and other items of interest to livestock men in the Territory are issued from time to time by the Animal Husbandry Division. You are invited to suggest other lines of research that you deem important and to submit inquiries to the University.

PINEAPPLE PLANTS AS FORAGE FOR CATTLE

By L. A. Henkel

Animal Husbandman, Hawaii Agricultural Experiment Station.

Object

Abandoned pineapple fields, or fields with a heavy growth of pineapple plants which is to be destroyed in order to plow and prepare the field for replanting, are sometimes found adjacent to pasture areas where because of prolonged drought the cattle may be in great need of forage. The question naturally arises as to the possible value of pineapple plants as a forage for cattle, either as a regular method of disposing of the old plants whenever a field is to be replanted and cattle pastures are adjacent, or as an emergency feed in periods of extreme drought when cattle in adjacent fields are literally starving.

Composition of Pineapple Plants

The following analyses of the total nutrients and the P205 and CaO content are by the Experiment Station of the Pineapple Producers Cooperative Association.

Special acknowledgement is due to Mr. Will Norman King, Agriculturist, and Dr. O. C. Magistad, Chemist, of the Experiment Station of the Pineapple Producers Cooperative Association, for their suggestions and continued interest and for supplying the pineapple plants and chemical analyses of same.

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plants and chemical analyses of same.

Nutrients in Pineapple Plants - Wet Basis

	Stumps	Leaves	Entire Plant
Water	65.00%	83.00%	79.50%
Carbohydrates, total	18.60	2.37	7.20
Sugars	.93	2.20	
Starch	16.10	.17	
Hemicellulose	1.57		
Crude protein	2.20	1.70	1.85
Fats	1.16	200 MM MM	500 MM MM

P205 and CaO in Pineapple Plants

	Percent P205	Percent Ca0
	'Dry basis'Wet basi	s* "Dry basis'Wet basis*
Lab. No. 7626	0.25 0.050	1.52 0.30
Lab. No. 7843	0.27 0.054	" 1.05 ' 0.21

Two analyses of the pineapple plants actually used in the feeding observation, to be detailed later in this report, are as follow:

Nutrients in Pineapple Plants - Dry Basis

Date obtained	8/24/33	9/26/33
	Percent Dry	Basis
Moisture	8.58	6.74
Crude protein	6.75	6.81
Ether extract	3.55	3.10
Crude fiber	22.39	21.09
Ash	5.67	5.81

Palatability of Pineapple Plants

Cattle may refuse to eat pineapple plants if ample other feed is available, but if this material is supplied in a cut or shredded condition, more or less mixed with other feeds, or if other feeds are withheld altogether, they will usually readily eat it after four or five days. However, even after being accustomed to it, our experience has not indicated that cattle will eat pineapple plants in preference to panicum and other commonly fed grasses if the latter are available.

^{* 80} percent moisture assumed.

Sutrionts in Pincapale Plants - Wet Basis

79.80%		800,00	
	2,37	36*	Carbonydrates, total
	0-4 M-9 F/M	0.0.0.0	Storeh Memicellulose
68.6	07. s.f.	2.26 L.16	Orade protein

PgOs and CaO in Pineapple Plants

Percent CaO	Percent PgOn	
	Taland teWhited vaG	
1.52 0.30	060.0 3 68.0	Lab. No. 7626
13.0 1 80.1	680.0 1 YS.0 1	

Two analyses of the pineapple plants actually used in the feed-

Nutrionts in Pineapple Plants - Dry Bapic

		Deniatde etall
Disc Designation of the column	20.00000 8.08 6.78 20.05 28.39 5.67	Moisture Brude protein Miner extract Grude fiber Ash

Palatability of Plosapula Planta

Cation may refuse to eat pineapple plants if small of the folded to swedled to swedled to swedled in a cut of the mare or less mixed with other foods, or if other feeds or attended altended, they will noughly readily out it after the folder of the days. However, even of the being securious to the folder of the file will est pineapple plants in preference to panious and other commonly fed grasses if the latter are available.

^{@ 80} percent moisture assumed.

Observation Tests to Determine Value of Pineapple Plants When Fed to Cattle

Earlier tests having indicated that cattle would eat pineapple plants if no other roughages were available, a test was planned to determine its value in producing gains in Holstein heifers averaging 543 lbs. in weight and 11 months in age at the beginning of the test. These heifers were confined in a dry lot and fed all the cut pineapple plants (the plants were run through an ensilage cutter but since the feeding roll did not hold the plants very well, they were shredded rather more than cut and not in very small pieces) which they would consume, the portions not eaten being weighed back each day. In addition they were fed concentrates, the amounts and kinds being different during the different six week periods and hence are reported separately as three observation tests. The heifers were weighed once each week and the initial and final weight for each six week period was the average of three weights taken on three consecutive days.

Observation Test III1 (6 weeks, Aug. 2 - Sept. 13, 1933)

In this test the regular heifer concentrate mixture was fed. This mixture contained the following feeds:

		Digestible					
			Dry Matter	Crude Protein	Total Nutrients	Nov. Cost	1933 Per Ton
			lbs.	lbs.	lbs.	0050	101 1011
		rolled barley	79.8	7.92	69.87	\$1.386	\$31.50
10	n	soybean oil					
		cake meal	8.9	3.97	8.45	.17	34.00
1	27	salt	1.0	~ ~	***	.008	15.00
1	33	raw rock					
		phosphate	1.0	pro too		.017	34.00
10	17	cane molasses	.7	.10	5.95	.002	5.00*
110	n	mixture	91.4	11.99	84.27	\$1.583	
100	11	n	83.1	10.90	76.61	1.44	

Two earlier, short observation tests on palatability are not included in this condensed account.

^{*} For purposes of calculating feed cost, cane molasses is assumed to cost \$5.00 and pineapple plants \$2.00 per ton.

Properties Tests to Betsteine Island of Riversald Elected of the Collins.

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In this test the regular liking concentrate mixture was fold

202_20E		ACOL	Directory about 200.	Not steel		
		70.00		2.00	rolled barley	
00.08	800.	8,45	VØ.K	8.9 Q.E	Lio naedyoa Leom smac tlea	3.0
900,8	V.CO., SCO.,	5.4	O.E.	1+0 2+		30 6
	\$1.00	86,87 76,63	30.90		eminie	

Two earlies, short observation tests on paistability are not included in this condensed account.

For purposes of celegisting feed cost, case molesco to accepting not to cost \$5.00 and pincapple plants \$5.00 per test.

During the six week period the average heifer consumed 22.2 lbs. of pineapple plants daily which with the 10 lbs. of concentrates fed daily supplied the following nutrients:

	Dry Matter 1bs.	Diges Crude Protein lbs.	Nutrients lbs.	Nov.	1933 Per Ton
10 lbs. heifer con- centrates 22.2 " pineapple plants 1	8.3 4.6 12.9	1.1 .3 1.4	7.7 1.3 9.0	\$.144 .022* .166	
Required - 600 lb. growing heifer (Morrison Standard)	13.8	1.2	9.2		

It will be noted that the above combination supplied a slight excess of crude protein and nearly enough total nutrients to meet the Morrison standard.

The initial and final average weights of each heifer at the beginning and end of the six week period were as follows:

Number	Final Weight	Initial Weight	Gain	Average daily gain
129 130 131	630 lbs. 617 " 577 "	560 lbs. 560 " 510 "	70 lbs. 57 " 67 "	1.67 lbs. 1.30 " 1.60 "
Average	608 "	543 "	65 n	1.55 "

Under the conditions of Observation Test No. III the heifers made satisfactory normal gains and the feed cost was \$20.94 or 10.7 cents for each pound of gain made. In this test 64.7 percent of the dry matter consumed came from good quality concentrates and 35.3 percent came from the pineapple plants.

Observation Test No. IV (6 weeks, Sept. 27 - Nov. 8, 1933)

In this test the concentrates were changed and reduced so that each heifer received daily, in addition to all the pineapple plants consumed, only two pounds each of cane molasses and soybean oil cake meal. Five pounds of raw rock phosphate and two pounds of salt were added to each hundred pounds of soybean oil cake meal fed in order to insure ample minerals. The cane molasses was largely poured over the pineapple plants hoping thereby to increase consumption of the latter.

The digestibility of the nutrients in pineapple plants has not been determined. In this and succeeding tests here reported they are assumed to be 2/3 digestible.

^{*} For purposes of calculating feed cost, cane molasses is assumed to cost \$5.00 and pineapple plants \$2.00 per ton.

Doring the six week period the average belies concurred 22.2 lbs. of processing which with the 10 lbs. of concentrates for cally supplied the following natriester:

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	Benefitsuk Pak	Protesta Loss	NOTICE TO SERVICE TO S	
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F. S. Jac	- 0, 3	E	0.85	ologacio * GaGG
			8,81 (Required * 500 lb. erowing heller (Moswison Standard

It will be noted that the above combination supplied a clight excess of arade protein and mearly enough total nutrients to neet the Morrison standard.

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1.07 10s. 1.30 E	90 108a 57 9 60 p	# 086 # 086 # 046	. 361 080 827 W 527 W	
9 20.5	90 BB			

Under the conditions of Observation Test Un. III the heifers make satisfactory normal gains and the feed cost was \$20.94 or 10.7 cents for cost pound of gain made. In this test 64.7 percent of the dry mater consumed came from good quality concentrates and 55.5 percent came from the pineapple plants.

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In this test the concentrates were changed and reduced so that each heiter received daily, in addition to all the pineapple plants consequed, only two pounts dean of cans molesses and swo pounds of say most phosphate and two pounds of salt were added to cash bundred pounds of coybean oil oaks meal fed in order to induce ample minorals. The cans molesses was largely noured over the pineapple plants hoping thereby to increase consumption of the latter.

The disconline of the netricute in gincapple plants has not been determined. In this and succeeding toute here reported they are essued to be 3/3 discortible.

For purposes of calculating food cost, cano molassos is escused to cost \$0.00 and pincapple plants \$2.00 per ton.

There was a two week interval between tests III and IV, during which time the change in concentrate feed was gradually made. The heifers continued to receive only pineapple plants for roughage.

As will be shown this ration did not meet the Morrison standard but we were hoping to induce the maximum consumption of pineapple plants and reduce the cost of the ration. The soybean oil cake meal was used to bring up the protein content of the ration.

During this six week period each heifer consumed an average of 45.6 pounds of pineapple plants daily in addition to two pounds each of cane molasses and soybean oil cake meal. This did not meet the Morrison requirements as shown below:

	Dry	Crude	Total	Nov. 1933
	Matter	Protein		Cost
Requirements:	lbs.	lbs.	lbs.	
(according to Morrison				
Standard)				
600 lb. growing heifer	13.8	1.20	9.2	
Supplied by:				
45.6 lbs. pineapple	0 "	m .a	0 %	# 045
plants	9.3	•56	2.7	\$.045
2.0 " cane molasses	1.5	.02	1.2	.005
2.0 " soybean oil	7 0	79. A	7 0	07.4
cake meal	1.8	.74	1.6	.034
Total	12.6	1.32	5.5	\$.084

It will be noted that the above ration supplied enough protein, but only about 60 percent of the desired total nutrients.

The initial and final weights of each heifer at the beginning and end of the six week period were as follows:

Number	Final Weight	Initial Weight	Gain	Average daily gain
129 130 131	650 lbs. 623 " 563 "	653 lbs. 627 " 587 "	- 3 lbs. - 4 " - 24 "	none "
Average	612 "	622 "	- 10 "	

Under the conditions of Observation Test No. IV all of the heifers lost slightly, which is not surprising since the nutrients supplied as already shown did not meet the requirements of the Morrison Standard. This ration seemingly supplied barely enough nutrients to maintain the animals but nothing above that on which growth and fattening could take place. It might have value as an emergency ration to merely maintain animals during a period of feed shortage due to drought or other causes.

In this case 25.5 percent of the dry matter consumed came from the soybean oil cake meal and cane molasses and the balance, 74.5 percent, came from the pineapple plants. The total feed cost in this test was \$10.61.

Observation Test No. V (6 weeks, Nov. 15 - Dec. 27, 1933)

Test No. IV having given unsatisfactory results as shown above, the concentrate ration was changed to the following mixture:

			Digestible			
			Dry Matter	Crude Protein	Total Nutrients	Cost Nov. 1933
			lbs.	lbs.	lbs.	NOV. 1999
100	lbs.	pineapple bran	82.2	2.4	52.0	\$.900
40	37	soybean oil cake meal		15.9	33.8	.680
5	17	salt	5.0	mo sap	400 900	.037
5	11	raw rock phosphate	5.0	Mary May		.085
150	77	mixture	128.0	18.3	85.8	\$1.702
100	11	11	85.3	12.2	57.2	1.135

Five pounds of this mixture, along with five pounds of cane molasses (largely poured over the pineapple plants) were fed daily to each heifer along with all the pineapple plants they would consume.

A week elapsed between tests IV and V, during which time the heifers were gradually changed to the new ration. During the six week period the heifers averaged 29.1 lbs. daily of the pineapple plants. In this case the maximum amounts of cheap, locally produced feeds were fed with the pineapple plant roughage, the concentrates consisting approximately of 50 percent cane molasses, 34 percent pineapple bran, 13 percent soybean oil cake meal and 3 percent minerals. With only 29 pounds of pineapple plants consumed daily, this, however, also failed to fully meet the Morrison standard.

		Digest	tible		
	Dry	Crude	Total		ost
	Matter	Protein	Nutrients	Nov	1933
Requirements:	lbs.	lbs.	lbs.		
650 lb. growing heifer	14.6	1.17	9.1		
Supplied by:					
29.1 lbs. pineapple plant	6.0	.36	1.8	\$.029
5.0 " concentrate mixture	e 4.3	.61	2.9	**	.057
5.0 " cane molasses	3.7	.05	3.0		.013
Total	14.0	1.02	7.7	\$.099

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ter and the second of the seco

The initial and final weights of each heifer at the beginning and end of the six week period were as follows:

Number	Final Weight	Initial Weight	Gain	Average Daily gain
129 130 131	670 lbs. 650 " 590 "	650 lbs. 630 " 577 "	20 lbs. 20 " 13 "	0.48 lbs. 0.48 " 0.31 "
Average	637 "	619 n	18 "	0.43 "

The results of this effort to feed large quantities of cane molasses along with only pineapple plants as the sole roughage can not be termed successful. While better results were secured than in test No. IV, they were far inferior to test No. III where ten pounds of a better concentrate mixture were fed. In this last test 57.2 percent of the dry matter came from concentrates, consisting mostly of cane molasses and pineapple bran, and 42.8 percent came from the pineapple plants. The total feed cost was \$12.39 or 23.4 cents for each pound of gain made.

The feces in this last test due to the large amount of cane molasses fed was dark and rather soft. One of the heifers, No. 129, seemed in fairly good condition at the end of the six weeks but the other two did not appear thrifty.

These heifers were put on the regular heifer concentrate mixture fed in Test No. III at the end of this test and were fed the regular roughages consisting largely of sudan, napier, and panicum grass, and in four weeks after being taken off the pineapple plant ration had made excellent gains as shown below.

Number	Weight at end pine-apple test on 12-27-33	Weights on re- After 2 weeks on 1-10-34	gular feeds After 4 weeks on 1-24-34	Average daily gain in 4 weeks
129 130 131 Average	670 lbs. 650 " 590 "	720 lbs. 690 " 650 "	800 lbs. 710 " 700 " 737 "	4.6 lbs. 2.1 " 3.9 "

These good gains made after the feeding of the experimental rations was discontinued indicates that the heifers had been fed an insufficient ration but seemingly they had not been injured, for when better feeds were supplied they immediately made good gains.

The initial and final weights of each heifer at the Deginning

alon yitage	0.159	faiting fanty frankley	
0.68 100. 0.48 0	20 10s. 20 m	650 1bs, 650 1bs, 650 m 630 m	
9 65.0		n eca n vsa	Arorage

The results of this effort to feed large quantities of oans solasses slong with only pineapple plants as the sole roughage can not be termed successful. While better results were secured that in test No. III where ten in test ten reunds of a better concentrate mixture were fed. In this last test for a percent of the dry matter came. from concentrates, consisting mostly of each molasses and pineapple bran, and 42.8 percent came from the pineapple plants. The total feed cost was \$12.59 or 23.6 sents for each pound of gain made.

The fepes in this last test due to the large sucent of our noisease fed was dark and ruther soft. One of the helfare, No. 159, seemed in fairly good condition at the end of the six weeks out the other two did not appear thrifty.

These heifers were put on the regular heifer concentrate minture fed in Test No. III at the end of this test and were fed the regular roughages consisting largely of sodan, napier, and panious grans, and is four weeks after being taken off the pineapple plant ration had made excellent gains as shown below.

	absol toluper a redia me sweet			
	AC-AS-I			
2.1 m	900 lbs. 710 E	720 lbs. 600 m	670 lbs. 650 m	
3.5 W	n 424			

These good gains usde after the feeding of the experimental retirement of the second of the feed the holders had been for the holders had been injured, for when better foods were supplied they inmediately usde good gains.

Summary and Conclusions

- l. In these tests three Holstein heifers, weighing about 600 pounds each, were fed shredded and cut pineapple plants as their sole roughage for a period of 147 days.
- 2. The average quantity of pineapple plants consumed daily by each heifer varied from 22 to 45 pounds depending on the kind and amount of concentrates fed. Decreasing the quantity of concentrates fed caused increased consumption of the pineapple plants but resulted in lower daily gains or even losses in the live weight of the heifers.
- 3. When the pineapple plants were supplemented with ten pounds of good quality concentrates daily for each animal, the heifers averaged 1.55 pounds daily gain over a six week period at a feed cost of 10.7 cents per pound gain.
- 4. When the concentrate supplement was reduced to two pounds each of soybean oil cake meal and cane molasses daily per heifer over a six week period, slight losses in the live weight of the heifers resulted.
- 5. When the concentrate mixture consisted of ten pounds daily of a mixture of cane molasses 50 percent, pineapple bran 34 percent, soybean oil cake meal 13 percent, and minerals 3 percent, an average daily gain of 0.43 resulted at a feed cost of 23.4 cents per pound of gain.
- 6. It appears from these observation tests that in order to get satisfactory gains in live weight, when using pineapple plants as the sole roughage, good quality concentrates must be fed at the same time.
- 7. The heifers were fed good concentrates and roughages at the termination of these pineapple plant tests and in the four week period immediately following pineapple plant feeding made an average daily gain of 3.5 pounds, indicating that the animals apparently had not been injured by five months of pineapple plant feeding.
- 8. While these tests do not indicate a high feeding value for pineapple plants, they do demonstrate that pineapple plants can be used to advantage as emergency feeds when pastures are dry from prolonged drought and no other forage crops are available.

Sungary and Conclusions

As In these tests three Holstein helfers, weighing about 500 pounds each, were fed shrodled and out pineapple plants as their sole roughage for a period of 167 days.

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of a mixture of come molarate mixture committed of tea pounds daily so mixture of come molarate bo percent, pincapple bran 54 percent, soverest daily main of 0.45 resulted at a feed cost of 25.4 cents per pound of main.

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termination of these pineapple plant tests and in the four week termination of these pineapple plant tests and in the four week period immediately following pineapple plant feeding made an average doily gain of 5.5 pounds, indicating that the animals apparently had not beek injured by five months of pineapple plant feeding.

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